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United States General Accounting Office

Report to the Chairman, Committee on Public Works and Transportation, House of Representatives

October 1988

BRIDGE IMPROVEMENTS

States Exercise Discretion in Selecting Projects Using Federal-Aid Funds

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GAO

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General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

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October 26, 1988

The Honorable Glenn Anderson
Chairman, Committee on Public Works
and Transportation
House of Representatives

Dear Mr. Chairman:

In its most recent report to Congress, the Federal Highway Administration (FHWA) reported that, as of December 1986, 220,000, or about 38 percent, of the nation's 576,000 inventoried bridges were either structurally deficient or functionally obsolete and eligible to receive federal funding under the Highway Bridge Replacement and Rehabilitation Program (HBRRP). In response to the interest you expressed in the results of our reviews of highway programs, we are providing this report, which examines (1) the HBRRP legislative requirements for selecting bridge projects and FHWA's role in the process, (2) the factors state transportation departments consider when deciding which bridges to replace or rehabilitate, and (3) the levels and sources of funding for states' bridge improvement programs. We discussed the results of our review with your office during briefings held over the past several months. This report summarizes those briefings.

Results in Brief

We found that the HBRRP legislation allows states considerable flexibility when selecting bridges for replacement or rehabilitation once FHWA has determined which bridges in the state are eligible to receive HBRRP funds. FHWA determines bridge eligibility on the basis of a sufficiency rating—a computation that measures the adequacy of a bridge to remain in service in its present condition. The rating is based on data obtained during bridge inspections performed by state and local governments or their designees. However, none of the six states we visited—Connecticut, Maine, Maryland, North Carolina, Pennsylvania, and Vermont—based their bridge selection decisions exclusively on the bridge sufficiency rating.

State transportation officials in all six states explained that while they generally use FHWA's sufficiency rating as an initial indicator of a bridge's condition, they believe that the rating itself does not adequately emphasize those factors they consider important when selecting a bridge for replacement or rehabilitation. For example, while FHWA's sufficiency rating takes into account average daily traffic on a bridge, it does not

distinguish between automobile and truck traffic or consider seasonal fluctuations in traffic flow. Similarly, while the rating does consider detour length necessitated by deficient bridges, it does not fully consider all impacts such bridges may have on communities. For example, two deficient bridges may have the same sufficiency rating, yet one bridge may warrant more immediate attention because it is the only access to a community, while the other bridge may serve a community with numerous access points.

HBRRP represents a significant source of funding for bridge improvements. Federal funds authorized for HBRRP for fiscal years 1987 through 1991 total $8.15 billion. In the six states in our review, the HBRRP apportionments for fiscal year 1986 ranged from $6 million in Maine to $112 million in Pennsylvania. Five of the six states also generated revenues in addition to their required HBRRP matching contribution (discussed in the following background section) to upgrade their bridges, generally through state gasoline taxes and bond issues. Total state contributions ranged from $5 million in Maine to $65 million to $70 million in Pennsylvania, including both states' 20-percent HBRRP contribution.

Background

The Surface Transportation Assistance Act of 1978 (P.L. 95-599) created HBRRP as the primary source of federal funding for replacement and rehabilitation of bridges on and off the federal-aid system.[1] Under HBRRP, the federal government provides states 80 percent of a bridge's replacement or rehabilitation cost, and states fund the remaining 20 percent. The Secretary of Transportation has delegated administration of HBRRP to FHWA.

The Surface Transportation Assistance Act of 1978 authorized a total of $4.2 billion for fiscal years 1979 through 1982 for HBRRP. A total of $6.9 billion was authorized for the continuation of HBRRP for fiscal years 1983 through 1986. In 1987, the Surface Transportation and Uniform Relocation Assistance Act authorized a total of $8.15 billion to continue HBRRP from 1987 through 1991.

[1]The nation's roadway network is composed of nearly 4 million miles of state and local roads, of which 829,000 miles constitute the federal-aid system and are eligible for federal assistance.

FHWA Determines Bridges Eligible for Federal Funding

The HBRRP legislation requires the Secretary of Transportation, in consultation with the states, to inventory all highway bridges in the nation (over 20 feet in length) on public roads, and classify them according to their serviceability, safety, and essentiality for public use. More than one-half million of these bridges throughout the nation are potentially eligible for HBRRP funding. Using the data collected by state and local governments during inspections of these bridges, FHWA classifies the deficiency and eligibility status of each bridge. A bridge must be both deficient by FHWA's definition and eligible under FHWA's sufficiency rating in order to qualify for HBRRP funding. In May 1988, we issued a report that evaluates the accuracy of the National Bridge Inventory and the possible effects that inaccuracies may have on the apportionment of program funding.[1]

As defined by FHWA, there are two distinct classes of deficient bridges: those in poor condition (regardless of configuration or design) and those with poor configuration or design (regardless of condition). Bridges in marginal or worse condition are considered structurally deficient, while a bridge no longer adequate for the road it is on and traffic it serves is considered functionally obsolete.

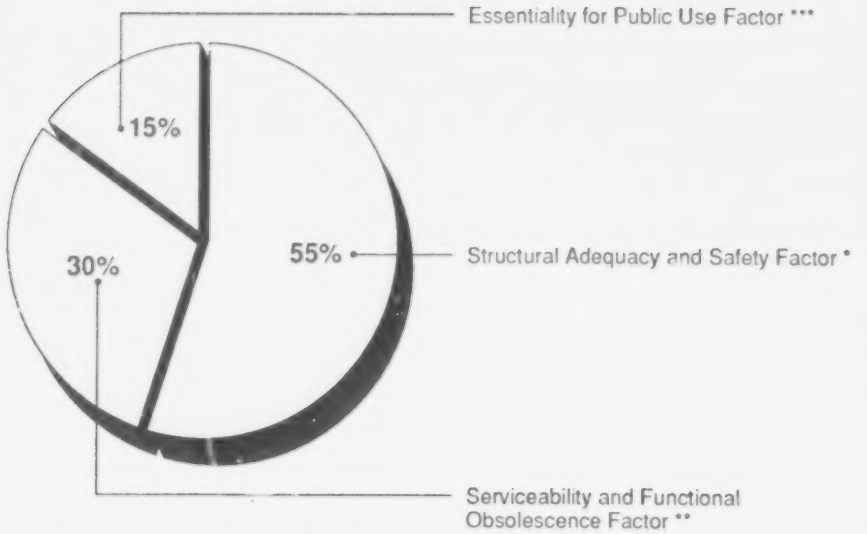
A bridge is classified as deficient if, when inspected, it receives a low rating on certain structural or functional bridge elements. Factors used to classify a bridge as structurally deficient include the condition of the deck, substructure, or superstructure, all of which affect how much weight the bridge can safely support. Factors used to classify a bridge as functionally obsolete include items such as average daily traffic count, the bridge deck geometry (e.g., the deck and roadway widths), underclearances, and approach roadway alignment (e.g., when the number of lanes is reduced because a bridge is narrower than the highway it serves).

FHWA designed the sufficiency rating as a method for evaluating factors indicative of a bridge's structural adequacy, safety, serviceability, and essentiality for public use. The sufficiency rating takes into account 19 of 90 bridge data items included in states' reports on their biennial bridge inspections. (See fig. 1 for the relative weights placed on each

[1] Bridge Condition Assessment: Inaccurate Data May Cause Inequities in the Apportionment of Federal-Aid Funds (GAO/RCED-88-75, May 20, 1988)

grouping of the 19 factors used to calculate the sufficiency rating.[1] The rating is expressed as a number between 0 and 100; the lower the rating, the worse the condition of the bridge.

Figure 1: Composition of FHWA's Sufficiency Rating



* Includes data items for the condition of the culvert or bridge superstructure, substructure, and the inventory rating (the capacity of the bridge to handle a certain load level safely for an indefinite period of time).

** Includes data items for the number of lanes, average daily traffic, approach roadway width/alignment, structure type/condition, bridge road width, under and vertical clearances, defense highway, deck condition and geometry, and waterway adequacy.

*** Includes data items for detour length, average daily traffic counts, and defense highway designation.

Note: The percentages noted above represent the maximum amount that can be attributed to each factor. The sum of these factors may be reduced by up to 13 percent depending on detour length and the adequacy of bridge safety features such as railings.

The sufficiency rating is also used to establish whether a bridge is eligible for HBRRP funding. To be considered eligible, a bridge must have a sufficiency rating of 80 or less. If a bridge has a rating 80 or less, it may

[1]Average daily traffic count is considered twice in the sufficiency rating calculation—once in consideration of the serviceability and functional obsolescence of the bridge and again in consideration of the bridge's essentiality for public use.

be rehabilitated using HBRRP funds. If the rating is less than 50, it may be either rehabilitated or replaced with HBRRP funds, at the state's option. FHWA forwards to the states listings of each state's inventoried bridges, which indicate whether each bridge is deficient and eligible for HBRRP funding. The states use this information along with their own criteria to rank and select bridges for rehabilitation and replacement.

HBRRP Legislation Does Not Prescribe Bridge Selection Criteria

As discussed above, FHWA designed the sufficiency rating to provide a general indication of a bridge's ability to remain in service in its present condition. However, states are not required to select for replacement or rehabilitation funding those bridges with the lowest sufficiency ratings. According to FHWA, bridges need only have a sufficiency rating of 80 or less to be eligible for HBRRP funding. The legislation is silent on the criteria that states are to use to select bridges for program funding. The legislation also does not prescribe a role for FHWA in selections of specific bridge projects, once FHWA's sufficiency rating criteria have been used to determine bridges that are eligible for funding.

Factors Considered by States When Selecting Bridges for Replacement or Rehabilitation

We obtained the factors considered in selecting bridge projects from state officials in Connecticut, Maine, Maryland, North Carolina, Pennsylvania, and Vermont. We chose these six states to obtain a cross section of states with varying percentages of deficient bridges and amounts of HBRRP apportionments. Although in each of the six states we found that state transportation officials consider a variety of factors when determining their bridge improvement priorities, we also found many similarities in the types of considerations made. For example, state transportation highway officials in all six states told us that they considered the average daily traffic counts and the load capacity (posting) or structural integrity of a bridge when selecting replacement or rehabilitation projects. Maryland, North Carolina, Pennsylvania, and Vermont also mentioned that they considered the impact of the length of detours (caused by posted or closed bridges) on a community and/or local industry. Two other frequently mentioned considerations were the remaining useful life or age of a bridge and the need to replace a bridge's deck; Maine, Maryland, and North Carolina each mentioned these factors.

In comparison with the other three states, Maine, Maryland, and North Carolina have more formal systems for evaluating their bridge improvement priorities. Maine categorizes its bridges into one of nine capital improvement categories that include rail and curb deficiencies, wearing surface deficiencies, deck replacement, superstructure replacement,

bridge widening, bridge rehabilitation, bridge replacement, and bridge removal. Of the nine categories, all are HBRRP-eligible activities except rail and curb, wearing surface, and bridge removal. Once bridges are assigned to a category, project priorities are assigned within each category using 6 of the 19 bridge data elements that are included in FHWA's sufficiency rating. Specifically, state officials assess the structural adequacy of a bridge's deck, superstructure, substructure, and culverts, as well as the adequacy of a bridge's deck geometry, underclearances, overclearances, and waterway clearances. (See app. II for details on Maine's bridge program and fig. 1 for details on FHWA's sufficiency rating.)

Maryland also ranks its bridge projects after categorizing its bridges according to the type of improvements needed. The categories include total replacement, deck replacement, major rehabilitation of items other than the deck, minor repairs, and preventative maintenance. Maryland gives special attention to bridge deck condition because of a problem with accelerated deck deterioration caused by the use of large quantities of de-icing salts during the winter months. Unlike Maine, however, Maryland has developed its own sufficiency rating system to evaluate its bridge deck replacement projects. The state's rating system awards points to factors such as percentage of the deck that has corroded, the remaining useful life of the deck if no repairs are made, traffic count, detour length, and the importance of the bridge to the community served. The higher the traffic count, for example, the greater the number of points awarded. (See app. III.)

North Carolina's Department of Transportation has developed a deficiency point system that enables state officials to rank bridges using level of service as the primary criterion. The magnitude of the deficiency of a bridge and its priority for improvement are determined by the sum total of weighted deficiency points. The system assigns weights to various elements used to assess each bridge's level of service: load capacity (70 percent), deck width (12 percent), vertical roadway under/overclearances (12 percent), and the estimated remaining life of the bridge (6 percent). For example, a bridge that is load-posted may be considered by North Carolina bridge officials to have a higher priority for replacement or rehabilitation than a bridge that has too few lanes to accommodate traffic easily without causing congestion. (See app. IV.)

FHWA System to Help States Rank Projects

FHWA has developed a bridge management system as a tool to help states rank bridge projects. The Surface Transportation and Uniform Relocation Assistance Act of 1987 required the Department of Transportation to evaluate the need for a comprehensive bridge management program for states' use in ranking bridges for replacement and rehabilitation. In response, FHWA developed a manual in 1987 that describes systematized procedures that states could choose to use in order to make cost-effective bridge management decisions. According to FHWA, the management system that it suggested for states' consideration is more structured than methods most states currently use. FHWA has not required states to adopt a bridge management system, but suggests that states use specific analytical tools to manage their bridge programs. The bridge management system manual that FHWA prepared discusses such tools in the form of four major components of bridge management: data collection, systems analysis, program formulation and implementation, and bridge program evaluation.

To promote use of a bridge management system, FHWA has presented a series of informational workshops to over 40 state transportation and highway agencies over the past year. The workshops are designed to demonstrate how the states can develop and implement a formal bridge management system tailored to the state's particular bridge needs. According to FHWA, a bridge management system will improve techniques states use to examine simultaneously the implications of undertaking bridge replacement, rehabilitation, and repair. FHWA's system suggests methods for managing bridge data base systems, techniques for weighing bridge data elements as input into project ranking decisions, and issues that should be considered in forecasting bridge needs such as analyses of life-cycle cost in relation to a bridge's age. FHWA believes that state bridge program managers can also expand their understanding of bridge condition and needs by expanding their bridge data bases to include data not currently kept in their bridge management system that may exist within a state agency, such as data on truck weight surveys, accidents, current maintenance costs, and the effect of maintenance on bridge deterioration rates.

Levels and Sources of States' Bridge Program Funding

Although varying amounts of information were available on the individual state's expenditures for bridge improvements, where information was available we found wide variances in the extent to which states supplemented their HBRRP apportionments, in addition to the 20-percent contribution that all states are required to make. According to Vermont transportation officials, Vermont did not generate any funds beyond its

20-percent share to replace or rehabilitate its bridges in fiscal year 1986, the most recent full year of program activity at the time of our review. Vermont's 20-percent share consisted of state funds plus some local contribution. Pennsylvania and Connecticut, on the other hand, generated between $65 million and $70 million, including their HBRRP share, according to state transportation officials. All of the five states that raise highway bridge funds generally do so through legislatively authorized bond issues or state gasoline taxes.

Objectives, Scope, and Methodology

To determine the various factors state transportation/highway agencies use to select bridges for replacement and rehabilitation under HBRRP, we examined (1) the HBRRP legislative requirements for bridge project selections and FHWA's role in the process, (2) the factors considered by selected state transportation/highway department officials in making bridge project decisions, and (3) the levels and sources of state funding for bridge improvement programs. Our review focused on the most recent full year of bridge program activity at the time of our review, which was generally the states' 1986 fiscal year.

We selected Connecticut, Maine, Maryland, North Carolina, Pennsylvania, and Vermont to obtain diversity among state bridge programs in terms of the percentage of deficient bridges, as reported by FHWA to the Congress in December 1986, and the amount of HBRRP apportionments in federal fiscal year 1986. Connecticut had the third largest percentage (63.2 percent) of deficient bridges in the nation, and Maine was ranked 33rd (30.4 percent of its bridges were deficient). Maine also had one of the smallest HBRRP apportionments of all states in fiscal year 1986—$6 million. Pennsylvania had one of the largest apportionments—$111.9 million. We also consulted with FHWA to identify states that it considered to have more progressive methodologies for ranking their bridge needs. FHWA identified Pennsylvania and North Carolina as two such states.

We obtained an indication of each state's annual funding commitment to bridge improvements by examining financial data that states could readily provide. Total expenditures for bridge projects for fiscal year 1986 are presented when they were readily available from the states. Annual expenditures reported may reflect use of prior years' apportionments as well as the fiscal year 1986 apportionment. This is because states are allowed up to 4 years to spend their annual HBRRP apportionments and moneys not expended during 1 year may be carried over to the following 3 years.

Our review was conducted in accordance with generally accepted government auditing standards between April 1987 and February 1988 at FHWA headquarters in Washington, D.C., the cognizant FHWA division offices, and the states' transportation or highway agencies. We also attended FHWA's Bridge Management System workshop in Albuquerque, New Mexico.

The results of our examination of factors considered in state bridge project selections are presented in appendixes I through VI.

Agency Comments

Comments on a draft of this report were provided by the Department of Transportation and the six states included in this review. The Department and the states generally found our report to accurately depict bridge selection processes. Several states suggested minor technical revisions, which we have incorporated in this final report where appropriate.

In elaborating on FHWA's management system presentation to states, the Department said that the principal reason for the presentations is to encourage states to develop and use advanced managerial and engineering techniques in managing their bridge programs. According to FHWA, these techniques can then be applied to a state's bridge inventory to ensure that bridge improvement expenditures are the most cost-effective possible. The Department anticipates states' adopting comprehensive bridge management systems as research and computer software needed to operate the systems become available.

In fact, Pennsylvania noted in its comments that a new, powerful programming tool became available to the state when its computerized bridge management system became operational after our visit. Pennsylvania said that its system has been helpful to the state in analyzing large amounts of data on bridge condition, traffic capacity, cost estimates, and remaining bridge life.

On the other hand, Vermont said in its comments that our report seemed to oversimplify inherent problems in states' adoption of the bridge management system. According to Vermont, even though FHWA's workshops have been informative, the development of a system requires a substantial expenditure of state funds and may result in potential duplication of efforts among the states. Vermont noted that to avoid this type of inefficiency, FHWA has, since our review was completed, begun working with states to set up computerized bridge management systems.

In a more recent discussion with FHWA officials, we learned that the FHWA effort to which Vermont referred is the second phase of FHWA's bridge management system project. FHWA has developed a computer model that it will provide to states for their use in analyzing long-term bridge needs and short-term priorities, including funding alternatives. According to an FHWA official involved in the project, states will have to absorb only the cost of installation of the computer program and any incidental costs associated with customizing the program to meet their data needs.

The texts of the Department's and state agencies' comments are included as appendixes VII through XIII.

We are providing copies of this report today to the Secretary of Transportation, the Administrator of FHWA, and other interested parties. Major contributors to this report are listed in appendix XIV.

Sincerely yours,

K. M. Mead

Kenneth M. Mead
Associate Director

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Abbreviations

CTDOT	Connecticut Department of Transportation
FHWA	Federal Highway Administration
HBRRP	Highway Bridge Replacement and Rehabilitation Program
MDOT	Maine Department of Transportation
NBI	National Bridge Inventory
NCDOT	North Carolina Department of Transportation
PCN	Primary Commercial Network
PennDOT	Pennsylvania Department of Transportation

Factors Considered by Connecticut in Ranking Bridge Projects

According to state officials, the State General Assembly passed a law in 1980 that required the Connecticut Department of Transportation (CDOT) to develop a system to evaluate all state bridges and classify their condition as poor, fair, good, or excellent. To meet this requirement, CDOT developed a condition rating system that is combined with the sufficiency rating to evaluate the state's bridges.

The condition rating system employs five elements: bridge deck; superstructure, including structural members and any drainage system; substructure, including structural members and drainage system; culvert condition, including alignment or settlement problems and retaining wall stability; and safe load capacity of the bridge. These 5 elements are currently included in the 19 elements that comprise FHWA's sufficiency rating formula (see fig. 1). However, according to CDOT officials, the sufficiency rating does not place adequate emphasis on a bridge's condition. Accordingly, CDOT is reluctant to use the sufficiency rating as the sole basis to set priorities for repairing or replacing the state's deficient bridges.

According to state transportation officials in Connecticut, the philosophy of the state is that bridge project selection should be based primarily on the relative structural condition of bridges. To ensure that the appropriate consideration is given to the structural integrity of bridges considered for improvement, Connecticut relies primarily on its own condition rating system to rank and select bridge improvement projects. The FHWA condition rating, as used in its sufficiency rating formula, requires inspectors to rate the bridge's deck, superstructure, substructure, and culvert condition, on a scale ranging from zero to nine. CDOT's condition rating system is also based on a scale of zero to nine, but it requires inspectors also to rate, on the condition rating scale, the safe load capacity of bridges.

State transportation officials also told us that they consider low vertical clearances and traffic volume when making bridge improvement project selections. Both of these items are included in FHWA's sufficiency rating, but less emphasis is placed on them than CDOT believes is necessary.

In 1980, according to state officials, the State General Assembly also mandated that CDOT develop a 10-year repair plan based on the safety, traffic conditions, scope of bridge improvements, and economic considerations of communities involved. State law also requires the Commissioner of Transportation to develop a rank listing of deficient bridges

each fiscal year. This listing is used to select bridges for the HBRRP program. According to a CDOT official, only bridges rated four or less on CDOT's condition rating scale are included on the annual priorities lists.

Bridge Program Funding

As of December 31, 1986, Connecticut had 2,375 deficient bridges out of a total of 3,758 bridges—a deficiency rate of 63.2 percent, according to FHWA. The state ranked third in the percentage of deficient bridges in the nation. In fiscal year 1986, 17 bridges were improved using HBRRP funds. Eleven were rehabilitated and six were replaced.

Revenues for CDOT's $1.0 billion state bridge program fund for 1985 through 1994 are generated from legislatively authorized bond issues, the proceeds of which are earmarked for bridge work. Connecticut also has a state gasoline tax, which is generally used for improving the state's roadways, but some of the funds are also used to upgrade bridges. CDOT spent $68.5 million of its own funds on bridge replacement and rehabilitation projects during state fiscal year 1987 (July 1, 1986, through June 30, 1987).

Federal funding of bridge work in Connecticut is substantially less than CDOT's extensive funding for bridge projects. The HBRRP apportionment in federal fiscal year 1986 totaled just over $38 million, while Connecticut spent $34.4 million in HBRRP funds during the state fiscal year 1987.

Factors Considered by Maine in Ranking Bridge Projects

According to Maine's Bridge Maintenance Engineer in the Bureau of Highways, the state's approach to bridge management is that, over the long run, a bridge properly maintained in the early stages of deterioration is less costly to repair than a bridge that has significantly deteriorated over time. Accordingly, Maine's goal is to maintain and replace the wearing surface of a bridge before the bridge deck deteriorates in order to prevent more costly damage and subsequent repairs and to extend its life span.

Maine's approach for addressing its needed bridge improvements, however, seems to run counter to the HBRRP funding criteria. According to one state bridge engineer, FHWA's practice of funding the replacement of bridges with the lowest sufficiency ratings provides a disincentive to states to prevent deterioration of bridges. A Maine transportation official also told us that states may be less inclined to use aggressive maintenance practices in the early stages of bridge wear because maintenance is not an HBRRP-eligible activity, and states and localities must, therefore, bear the cost of such activities themselves. Although total bridge replacement is an HBRRP-funded activity, it is not necessarily the optimum alternative for states since HBRRP funds must then be concentrated on fewer bridges. The official stated that from the state's perspective, though HBRRP would carry the majority of project costs (80 percent), the 20-percent state contribution could be spread much further if not all bridges were in need of total replacement.

When ranking bridge improvements, the Maine Department of Transportation (MDOT) categorizes its bridges into one of nine capital improvement categories. The types of improvements include rail and curb deficiencies, wearing surface deficiencies, deck replacement, superstructure replacement, substructure rehabilitation, bridge widening, bridge rehabilitation, bridge replacement, and bridge removal. Once bridges are assigned to a category, they are initially ranked within that category using FHWA's condition and appraisal rating criteria. Maine also considers the age of each bridge, as well as the bridge's load capacity, accident frequency, roadway width, and average daily traffic count.

According to Maine's transportation officials, the state does not use FHWA's sufficiency rating exclusively to select bridges for replacement or rehabilitation. Rather, it uses the rating as a guide to generally identify bridges that need capital improvements.

Maine also generates a biennial bridge deficiency list. The Maine Department of Transportation, Bureau of Planning, recommends the level of

funding and, in concert with Bridge Maintenance and Bridge Design, identifies bridges for which the funds should be used.

Bridge Program Funding

As of December 31, 1986, Maine had 787 deficient bridges out of a total of 2,590 bridges—a deficiency rate of 30.4 percent, according to FHWA. Maine ranked 33rd in the percentage of deficient bridges in the nation.

In fiscal year 1986, Maine received HBRRP funds of just over $6.0 million. According to an MDOT official, the state spent $5 million in state funds to upgrade its bridges. Contracts were awarded on 16 bridges in fiscal year 1986, which included 11 replacements and 5 rehabilitations, using both federal and state funds.

State-funded bridge improvements are financed through legislatively approved bond issues. Ultimately, however, all bridge improvements are funded with state gasoline tax and other highway revenues, since the bond indebtedness is paid off with highway revenues.

Factors Considered by Maryland in Ranking Bridge Projects

The Maryland Department of Transportation in the State Highway Department evaluates its bridge needs according to the type and extent of work required. Ranking bridge projects begins with the categorization of bridges according to the type of improvements needed. Bridge problems are divided into one of five categories: total bridge replacement, total deck replacement, major rehabilitation other than deck, minor repairs, and preventive maintenance.

The Maryland bridge program evaluates bridge deck replacement as a separate category because of a serious deck deterioration problem caused by use of large quantities of de-icing salts during the winter months. Maryland has developed its own sufficiency rating system for evaluating candidates for bridge deck projects. The state's system awards points to factors such as percentage of the deck that has corroded, the remaining useful life of the deck if no repairs are made, traffic count, detour length, highway type (e.g., interstate, two lane highways), the importance of the structure to a community, and political sensitivities to specific bridge improvements. The higher the traffic count, for example, the greater the number of points awarded. Once a sufficiency rating is derived after consideration of the above criteria, bridge deck priorities are identified by consensus of officials from the Bureaus of Bridge Design, Bridge Inspection and Remedial Engineering, and Bridge Development. The state bridge inspectors are also consulted as needed.

To determine whether to replace or rehabilitate a bridge, however, Maryland uses a weighted system for measuring the cost of each type of improvement, how long alternative improvements are expected to lengthen the bridge's service life, and aesthetics. Bridge candidates are also ranked on the basis of traffic volume; bridge condition; other characteristics, such as load-posting (i.e., restricted to light vehicles); and the FHWA sufficiency rating. Maryland focuses its attention on the bridge traffic counts, the essential nature of the bridge as an access route, and the effect of an ongoing rehabilitation project on local businesses.

A rank listing of bridge projects is developed from the priorities identified. A consolidated priorities list is then forwarded to the Chief Bridge Engineer, who makes the final selections of the bridges to be funded for the upcoming fiscal year.

Bridge Program Funding

As of December 31, 1986, 1,549 of 4,335 bridges in Maryland, or 35.7 percent, were deficient, according to FHWA. Nationally, the state ranked 26th in the percentage of deficient bridges.

In fiscal year 1986, Maryland received an HBRRP apportionment of $30 million. In 1986, Maryland also contracted for the replacement or rehabilitation of 24 HBRRP-eligible bridges. In 1986, contracts were awarded to replace 15 bridges and rehabilitate 9 bridges.

Based on data provided by Maryland transportation officials, estimated construction expenditures for new bridges and culverts during fiscal year 1986 totaled $132.7 million (including federal and state funding sources) for 50 projects. State records did not distinguish federal and state funding of contracts for fiscal year 1986. Maryland also finances its highway and bridge work through a motor fuel tax, although most of its revenues are not earmarked specifically for bridge projects.

Factors North Carolina Considers in Ranking Bridge Projects

Bridge project ranking and selection are performed by the State Bridge Maintenance Engineer's program staff in the North Carolina Department of Transportation (NCDOT). NCDOT's procedure is to consider for improvement only those bridges rated 50 or less on FHWA's sufficiency rating scale. Selections are made with the help of information obtained from inspection reports, recommendations of seven state bridge superintendents located in the state's seven maintenance areas, and FHWA's sufficiency rating for each bridge.

NCDOT also uses a bridge priority ranking process developed by North Carolina in conjunction with The Institute for Transportation Research and Education, which includes the University of North Carolina and North Carolina State University. The deficiency point system ranks bridges using level of service goals as the primary criterion. The system assigns weights to various elements used to assess the bridge's level of service goals: the single vehicle load capacity (70 percent), clear bridge deck width (12 percent), vertical roadway under/overclearances (12 percent), and the estimated remaining life of the bridge (6 percent). The magnitude of a bridge's deficiency is indicated by the total of deficiency points. The more points, the greater the deficiency status of a bridge. Each year a rank order listing of bridges is generated on the basis of the deficiency point system. This process is the starting point for bridge improvement project decision-making.

Although some of the same factors considered in the deficiency point system are also included in FHWA's sufficiency rating (e.g., safe load capacity), the sufficiency rating does not weigh load capacity as heavily as the state believes is necessary, according to NCDOT officials. The deficiency rating system enables NCDOT to place what it believes to be the appropriate weights on such items. For example, if transportation of goods associated with North Carolina's logging industry were hampered by weight-posted bridges, the state ultimately would suffer an economic impact. Many bridges in the state have lower weight requirements, thus restricting truck traffic. The NCDOT officials explained that FHWA's sufficiency rating does not consider the economic effect of detours resulting from such restrictions nor their impact on industry.

Bridge Program Funding

According to FHWA as of December 31, 1986, there were 9,124, or 56.8 percent, of the 16,058 bridges in the state that were deficient. Nationally, the state ranked eighth in the percentage of deficient bridges.

Funds generated from North Carolina's tax on gasoline are used for general highway programs and provide the state with funds needed for the HBRRP. According to state bridge officials, North Carolina also replaces bridges not eligible for HBRRP funding because they are less than the required 20 feet in length. In fiscal year 1986, state maintenance crews replaced 129 such bridges at a cost of about $4 million.

According to a state transportation official, North Carolina relies primarily on HBRRP to fund its replacement and rehabilitation projects. In fiscal year 1986, the state received an HBRRP apportionment of $45 million, which it used to contract for replacement of 44 bridges and rehabilitation of 2 others. North Carolina's bridge program budget from 1981 through 1986 has averaged about $54 million per year. This figure includes the HBRRP apportionment, the 20-percent state contribution toward HBRRP, and the $4 million in state revenues to replace bridges not funded by HBRRP.

Factors Pennsylvania Considers in Ranking Bridge Projects

According to Pennsylvania Department of Transportation (PennDOT) officials, the Pennsylvania General Assembly earmarked in 1982 approximately 979 bridge projects in the state for replacement or rehabilitation, with passage of the "Billion Dollar" bridge act. In 1986, a second bridge act was passed by the legislature designating an additional 3,000 bridges for improvement.[1]

According to PennDOT officials, the first bridge act focused on bridges on state highway networks that served as key access routes for the agricultural and industrial communities. According to district engineers, this bridge act was constructed rather quickly in the headquarters office of PennDOT with a less systematic procedure than was used for the second bridge act. A primary objective in selection of bridges was the elimination of load-posted bridges.

According to district engineers, the second bridge act was derived using a more systematic procedure to incorporate all 11 of the state's district engineers' recommendations for bridge projects. This act placed more emphasis on locally owned bridges than did the first bridge act. Each of the three districts we examined developed a candidate bridge list and then forwarded its recommendations to PennDOT headquarters for final approval.

Engineers from three districts representing large cities with many bridges (Pittsburgh and Philadelphia) and rural areas with agricultural vehicle traffic (Harrisburg) and headquarters officials told us the state bridge program priority was the elimination of load-posted bridges that inhibit the flow of commercial and agricultural vehicles on designated state highway networks and create long detours for the motoring public.

In categorizing bridge improvement needs, district engineers told us that they consider whether a bridge is on either the Primary Commercial Network (PCN) or the Agri-Access Network. The PCN is a 12,000-mile system of the state's most important commercial routes essential to the movement of materials and manufactured products throughout the state. The Agri-Access Network is an extension of the PCN, providing an interconnecting system of highways for transport of agricultural commodities, supplies, and wood products. Bridge obstructions on these networks that warrant attention include vertical clearances and poor

[1]Pennsylvania's comment on this report states that the bridge acts were amended in March 1988 to authorize the expenditure of state funds for an additional 800 state and local bridge projects worth approximately $500 million. (See app. XII.)

highway geometry, especially at the highway intersection and curves. Posted bridges are given more attention, according to one district engineer. Given the condition of the bridge, attention is then focused on the locations of industry, emergency services, and school bus routes—none of which is evaluated in FHWA's sufficiency rating.

Bridge Program Funding

According to FHWA, as of December 1986, approximately 7,922, or 35.4 percent, of the 22,200 bridges in Pennsylvania were deficient. Nationally, Pennsylvania ranked 27th in the percentage of deficient bridges.

The state of Pennsylvania received one of the largest HBRRP apportionments in fiscal year 1986—about $111.9 million. In addition, in the 1982 bridge act the state legislature passed an axle tax on trucks to fund the bridge program. According to PennDOT officials, this tax generated about $65 million to $70 million annually for the bridge program. The axle tax was subsequently found to be unconstitutional since it applied only to out-of-state vehicles, thereby giving preferential treatment to state-registered vehicles. In 1987, Pennsylvania replaced the axle tax with a motor fuel tax.

In state fiscal year 1986, HBRRP funds were used to award contracts to replace 26 bridges and rehabilitate 2 bridges.

Factors Vermont Considers in Ranking Bridge Projects

The Vermont Agency of Transportation is responsible for compiling a list of bridges that need replacement or rehabilitation. Bridges are ranked at the headquarters level. The state Structures Engineer, in consultation with his bridge inspection staff, develops a listing of bridges to be upgraded. The agency prepares this listing on the basis of its inspection reports, traffic reports, and FHWA's sufficiency rating. It also considers the views of field staff engineers as well as concerns raised by citizens. The listing is then sent to the Agency Planning Division, which develops a candidate list for submission to the state legislature for final approval.

Vermont officials use FHWA's sufficiency rating as a general guide to identify deficient bridges that can be upgraded using HBRRP funds. Vermont places some reliance on the sufficiency rating as a general indication of a bridge's structural condition. According to state officials, factors are also independently considered to select bridge projects for HBRRP funding—such as average daily traffic, detour lengths, and whether a bridge is weight restricted—even though they are included in the computation of the sufficiency rating to ensure that adequate emphasis is placed on them. In addition, state officials advised us that they also consider accident rates and whether a bridge is on a school bus route.

Bridge Program Funding

According to FHWA, as of December 31, 1986, Vermont had 1,156 deficient bridges out of a total of 2,659 bridges—a deficiency rate of 43.5 percent. The state's bridge deficiency rate ranked 23rd in the nation.

Vermont generally selects bridges at the lower end of the sufficiency rating scale first, which generally means more bridges are replaced than are rehabilitated using HBRRP funds. In 1986, contracts were awarded for 17 bridge improvement projects: 16 bridges were replaced and 1 bridge was rehabilitated.

Vermont's expenditures are generally limited to the funds needed to apportion funds for the FHWA bridge program. In fiscal year 1986, Vermont was apportioned $8.3 million in HBRRP funds, and the required 20 percent was contributed by state and local sources. All state revenue for the contribution is generated from the state fuel tax, state sales tax on motor vehicles, and motor vehicle fees.

Comments From the U.S. Department of Transportation

U.S. Department of Transportation

Assistant Secretary for Administration

400 Seventh St. S.W. Washington, D.C. 20590

SEP 14 1988

Mr. Kenneth M. Mead
Associate Director
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Mead:

Enclosed are two copies of the Department of Transportation's comments concerning the U.S. General Accounting Office draft report entitled, "Bridge Improvements: States Exercise Discretion in Selecting Projects Using Federal-Aid Funds."

Thank you for the opportunity to review this report. If you have any questions concerning our reply, please call Bill Wood on 366-5145.

Sincerely,

Jon H. Seymour

Enclosures

Enclosure

DEPARTMENT OF TRANSPORTATION

REPLY TO GENERAL ACCOUNTING OFFICE (GAO) REPORT OF AUGUST 4, 1988 ON BRIDGE IMPROVEMENTS: STATES EXERCISE DISCRETION ON SELECTING PROJECTS USING FEDERAL-AID FUNDS

Summary of GAO Findings and Recommendations

The GAO found that the Highway Bridge Replacement and Rehabilitation Program (HBRRP) legislation allows states considerable flexibility when selecting bridges for replacement or rehabilitation once the Federal Highway Administration (FHWA) has determined which bridges in the state are eligible to receive HBRRP funds. Although the FHWA determines bridge eligibility on the basis of a sufficiency rating, the GAO found that none of the six states reviewed based their bridge selection decisions exclusively on the bridge sufficiency rating. The GAO also found that the HBRRP represents a significant source of funding for bridge improvements. Federal funds authorized for the HBRRP for fiscal years 1987 through 1991 total $8.15 billion.

The report contains no recommendations.

Summary of Department of Transportation Position

DOT is in general agreement with the GAO draft report. As described in the GAO draft report, each state believes that it has unique considerations it must evaluate when establishing bridge improvement priorities. The FHWA sufficiency rating formula is used as a general guide to identify groups of bridges as candidates for improvement. Individual state priority ranking systems are applied to the FHWA identified candidates to arrive at actual project priority list.

The GAO draft report does generally describe the FHWA demonstration presentations and manual on bridge management systems. However, the report does not discuss the principal reason for the FHWA bridge management system presentations. That reason is to encourage the states to develop and implement advanced managerial and engineering techniques. These techniques can be applied to the entire state bridge network to ensure that bridge improvement expenditures are the most cost-effective possible.

The FHWA is encouraging the implementation of bridge management systems which include consideration of user costs. During the next several years, it is highly likely that the states will adopt comprehensive bridge management systems as the tools, software, and general research become available.

Comments From the Connecticut Department of Transportation

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION
24 Wolcott Hill Road, P.O. Drawer A
Wethersfield, Connecticut 06109

Office of the Commissioner

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August 16, 1988

Mr. Kenneth M. Mead
Associate Director
Resources, Community and Economic
Development Division
United States General Accounting Office
Washington, D. C. 20548

Subject: Draft Report on Bridge Improvements
GAO/RCED-88-188

Dear Mr. Mead:

Thank you for your letter dated August 4, 1988 by which you transmitted a draft report entitled Bridge Improvements: States Exercise Discretion in Selecting Projects Using Federal-Aid Funds, and requested our review and comments on the report prior to its issuance in final form to the Committee on Public Works and Transportation, United States House of Representatives.

We appreciate the opportunity to participate in your study process, and are especially appreciative of the financial support afforded to Connecticut under the provisions of the Federal Highway Bridge Replacement and Rehabilitation Program.

Connecticut has no substantive comments to make relative to the report in general or of that section of the report (Appendix I) which addresses factors considered by Connecticut in ranking bridge projects. I would emphasize the fact that our current State Ten-Year Bridge Infrastructure Renewal Program is very large (currently in excess of $1.3 billion dollars), and consequently the HBRR program provides less than half of our yearly expenditures for the repair or replacement of deficient bridges.

During the current Federal fiscal year, Connecticut has been obliged to defer the use of substantial amounts of HBRR funding because of overall obligation authority restrictions imposed on the use of Federal-Aid highway funds. Those bridges that had been selected for rehabilitation with HBRR funding were advertised for construction using all State funding. However, we plan to schedule additional projects for next year's HBRR program in order to avoid the possibility of lapsing any HBRR apportionments in future years.

Very truly yours,

J. William Burns

J. William Burns
Commissioner

Comments From the Maine Department of Transportation

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
TRANSPORTATION BUILDING
STATE HOUSE STATION 16 AUGUSTA, MAINE 04333

mdot

DANA F. CONNORS
Commissioner

August 31, 1988

Mr. Kenneth Mead, Associate Director
United States
General Accounting Office
Resources, Community, and
Economic Development Division
Washington, D.C. 20548

Subject: GAO Draft Report - Bridge Improvements

Dear Mr. Mead:

A review of the Draft Report on Bridge Improvements GAO/RCED-88-188 has been completed. Minor corrections are suggested for pages 9, 20 and 21.

In regard to page 9, note that all categories except rail-and-curb, wearing surface, and bridge removal, are eligible for HBRRP activities.

In regard to page 20, third paragraph, second sentence, it should read: "The Maine Department of Transportation, Bureau of Planning recommends the level of funding, and in concert with Bridge Maintenance and Bridge Design identifies the bridges for which the funds should be used".

In regard to the first paragraph on page 21, note that Maine uses funds other than HBRRP to improve bridges. Most of the bridge projects using other state and federal funds would be eligible for improvement using HBRRP funds. To put the matter in perspective, Maine programmed $32 million for bridge improvements in 1988-1989, and will receive only about $12 million of HBRRP funds.

In regard to the second paragraph on page 21, note that ultimately all improvements are financed with motor fuel and other highway revenues, since bond indebtedness is paid off with highway revenues. Also note that less than 40% of revenues are used for maintenance, with about an equal amount used for capital improvements.

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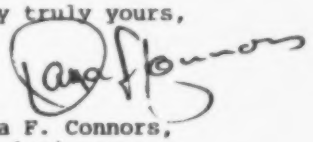
The report represents a fair appraisal of the subject in all other respects, as best as we can tell.

Very truly yours,



Dana F. Connors,
Commissioner

DFC/JC/wsb

Comments From the Maryland Department of Transportation

Maryland Department of Transportation
The Secretary's Office

William Donald Schaefer
Governor
Richard H. Trainor
Secretary
Stephen G. Zentz
Deputy Secretary

September 1, 1988

Mr. Kenneth M. Mead
Associate Director
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Mead:

We appreciate the opportunity to review your draft Report on "Bridge Improvements, States Exercise Discretion in Selecting Projects Using Federal-Aid Funds." We have reviewed the report and find its contents to be accurate as they apply to Maryland's procedures.

It was informative to see how some of the other states are dealing with the problem of selecting structures to be replaced or rehabilitated. We feel our current selection system is as good or better than those states mentioned in the report.

Both State Highway Administrator Hal Kassoff and I would appreciate receiving a final copy of the report when it is available. Mr. Kassoff's address is 707 North Calvert Street, Room 400, Baltimore, Maryland 21202.

We thank you for selecting us for inclusion in this report.

Sincerely,

Richard H. Trainor
Secretary

RHT:mp

cc: Mr. Hal Kassoff

My telephone number is (301) 859-7397
TTY For The Deaf (301) 859-7227
Post Office Box 8755, Baltimore/Washington International Airport, Maryland 21240-0755

Comments From the North Carolina Department of Transportation

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
P. O. BOX 25201
RALEIGH 27611-5201

JAMES G. MARTIN
GOVERNOR

JAMES E. HARRINGTON
SECRETARY

September 1, 1988

Mr. Kenneth M. Mead
Associate Director
Resources, Community, and Economic
Development Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Mead:

Our Bridge Maintenance Unit has reviewed the draft report entitled Bridge Improvements: States Exercise Discretion in Selecting Projects Using Federal-Aid Funds (GAO/RCED - 88 - 188).

The section describing North Carolina's program accurately depicts the process utilized in the selection of bridges for replacement or rehabilitation. There are however, several technical revisions which staff has recommended.:

1. Page 27 - The figures below have been revised or updated as follows:
The HBRRP apportionment for FFY '86 was $45 million. These funds were used for the replacement of 44 bridges and rehabilitation of 2 others. When the apportionment is adjusted by the 20 percent matching state contribution and the $4 million in state revenues not funded by HBRRP, the amount averages to $60 million for fiscal year 1986.

   In addition, the report states North Carolina's bridge program budget averages approximately $56 million. However, North Carolina Department of Transportation figures for the years 1981 through 1986 result in an average figure of approximately $54 million each year, this figure gives a more accurate account of the expenditures that were available during this time period.

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For the above reasons, Page 27 (Appendix IV) is revised as shown below.

APPENDIX IV

In fiscal year 1986, the state received an HBRRP apportionment of $45.0 million which it used to contract for replacement of 44 bridges and rehabilitation of 2 others. North Carolina's bridge program budget average about $54 million each year for the years from 1981 through 1986. This figure includes the HBRRP apportionment, the 20 percent matching state contribution toward HBRRP and the $4 million in state revenues to replace bridges not funded by HBRRP.

See comment 1

You will note from the above expenditures, the primary source of funding for bridge improvements in North Carolina is the HBRRP. A requirement in this program provided under Sec. 123(g)(3) of P.L.100-17 specifies that at least 15% but not more than 35% of the amounts apportioned may be spent on off-system bridges. Considering we maintain all bridges on public roads except those owned by municipilities and other governmental agencies, such a provision prevents us from expending dollars where they are needed most. According to 1987 FHWA data, approximately 58% of our needs are on the off-system bridges. If the provision were modified to increase the requirement for expenditures for off-system bridges, our most critical needs on a total network basis could be addressed, thereby providing North Carolina with a more effective Bridge Management System.

We are proud of our bridge maintenance program and appreciate being identified as one of the states considered to have a progressive methodology for ranking our bridge needs. Some of the elements developed in our program have been incorporated into systems in other states, such as Pennsylvania, Virginia, Neoraska and Kansas.

Thank you for the opportunity to be included in the study and review this report. Please let us know if we can be of further assistance.

Sincerely,

James E. Harrington

JEH/hb

The following is GAO's comment on the North Carolina Department of Transportation's letter dated September 1, 1988.

GAO Comment

1. Our review focused on state procedures for selecting bridges to be replaced or rehabilitated under HBRRP. Although we obtained information on projects funded by the states, we did not evaluate the HBRRP legislation's spending limit for off-system bridges (35 percent of the annual apportionment). As a result, we are not in a position to know what, if any, impact this funding limit has on state bridge management programs.

Comments From the Pennsylvania Department of Transportation

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
HARRISBURG, PENNSYLVANIA 17120

OFFICE OF
SECRETARY OF TRANSPORTATION

August 24, 1988

Mr. Kenneth M. Mead, Associate Director
United States General Accounting Office
Resources, Community, and
Economic Development Division
Washington, D.C. 20548

Dear Mr. Mead:

This is in response to your request for comments regarding the draft report entitled Bridge Improvements: States Exercise Discretion in Selecting Projects Using Federal-Aid Funds.

Overall, we find the draft report informative and to the point in explaining the practices used by the six states in selecting bridge projects for replacement and rehabilitation, and describing the sources for funding bridge projects.

The following are our comments regarding Pennsylvania's practice in selecting bridge projects for replacement and/or rehabilitation.

The draft report correctly describes the method used by the Department of Transportation in selecting bridge projects. However, it should be noted that a new powerful programming tool became available to the Department when Pennsylvania's computerized Bridge Management System (BMS) became operational in early 1987. BMS, by providing a large data base, greatly facilitates selection of bridge projects for rehabilitation and/or replacement.

For programming purposes, BMS provides necessary information such as bridge condition, weight restriction, detour length, ADT, and cost estimate, and assigns a remaining service life to every bridge. This information is used to prepare prioritized lists of bridge needs for each of the eleven Engineering Districts. These prioritized lists are then used by Department managers to determine the most effective long term program, and to assure that the programming goals, such as elimination of all closed/posted bridges on the state priority networks, are met.

The draft report mentions two pieces of Bridge Bill legislation that authorized state funding for 4,300 state and local bridges. In March, 1988, the previous two Bridge Bills were amended to authorize the expenditures of state funds for an additional 800 state and local bridge projects worth approximately $500 million.

Mr. Kenneth M. Mead, Associate Director
Page 2

I thank you for the opportunity to comment on your report and I congratulate you on the job well done.

Sincerely,

Howard Yerusalim

Howard Yerusalim, P.E.
Secretary of Transportation

Comments From the Vermont Department of Transportation

STATE OF VERMONT
AGENCY OF TRANSPORTATION
133 State Street, Administration Building
Montpelier, Vermont 05602

August 17, 1988

RE: Draft Report
Bridge Improvements

GAO-RCED-88-188

Mr. Kenneth M. Mead
United States General Accounting Office
Resources, Community and Economic Development Division
Washington DC, 20548

Dear Mr. Mead:

Thank you for transmitting a copy the draft report on bridge improvements to us for review. We are in general agreement with the data contained in this report, but do have a few comments as follows:

1. The discussion of a bridge management system, which begins on page 10 of the draft, seems to oversimplify the problem. Although FHWA has presented a workshop and does have a manual available, a bridge management system is a very complex program. If each State develops their own system, there will be a very large expenditure of funds and in many cases, it will be duplicative effort by several states. In an effort to avoid this, FHWA is moving into another phase of the bridge management system project, whereby it is working with states to develop a comprehensive program that could be used by as many states as so desire. Some of this has developed since the time frame of your report, but it might be well to make some mention of it.

2. On page 12 of the draft, it is indicated that Vermont does not generate any funds beyond its 20 percent share. For clarity, it should be noted that the Vermont share of 20 percent consists of State funds plus, in the case of off-system bridges, some local contribution. An additional 1.6 million dollars of State funds are appropriated annually by the State legislature. These funds are supplemented by 20% local funding for the purpose of reconstructing or replacing local bridges.

Draft Report
August 17, 1988
Page 2

3. On page 31, the last sentence of the first paragraph indicates a listing is sent to the State Planning Division. This should be revised to indicate Agency Planning Division.

4. On page 32 of the draft, in the final paragraph, the first sentence indicates that the legislature authorizes the sale of bonds. For many years, all of our State revenue for match of all projects has been generated from the State fuel tax, State sales tax on motor vehicles, and motor vehicle fees. Bonds have not been used for any of this work. We would also like to have the last sentence of that same paragraph deleted as it is not correct.

Thank you for giving us the opportunity to review this draft. If you have any question, please contact this office.

Your truly,

Susan C. Crampton
Secretary of Transportation

SCC/WBT/wla

Major Contributors to This Report

Resources, Community, and Economic Development Division, Washington, D.C.	Kenneth M. Mead, Associate Director, (202) 275-1000 Victor S. Rezendes, Associate Director James R. Hunt, Group Director Jacquelyn L. Williams, Assignment Manager Walter L. Allen, Evaluator Janet L. Fong, Evaluator
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